

***Persoonia manotricha* (Proteaceae: Persoonioideae), a new species
associated with Banded Iron Formation ranges in the Midwest region,
Western Australia**

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Abstract

Butcher, R. & Markey, A.S. *Persoonia manotricha* (Proteaceae: Persoonioideae), a new species associated with Banded Iron Formation ranges in the Midwest region, Western Australia. *Nuytsia* 17: 135–146 (2007). The new species, *Persoonia manotricha* A.S. Markey & R. Butcher, is morphologically similar to *P. bowgada* P.H. Weston and *P. hexagona* P.H. Weston in its habit, in having six alternating grooves and ridges on its subterete, pungent leaves and in its floral structure. While its leaf morphology and anatomy closely ally *P. manotricha* with *P. bowgada*, the new species can be distinguished by its longer pedicels and by its flowers being less pubescent with a glabrous to sparsely pubescent ovary, similar to those of *P. hexagona*. Comparative leaf anatomy confirms that *P. hexagona* is distinctly different in having relatively broad longitudinal grooves in its leaves. The characteristic darkness of these broad grooves, in dried specimens, is not exclusively the result of the stomatal guard cells blackening, as previously thought, but also results from the greater visibility of the underlying mesophyll. *Persoonia manotricha* is commonly found on the lower, rocky slopes of Banded Iron Formation (BIF) ranges in tall *Acacia* dominated shrubland. A taxonomic description of the new species, including images and a distribution map, is provided. The new species is integrated into the most recently published key to *Persoonia* species.

Introduction

In recent revisions of *Persoonia* Sm., Weston (1994, 1995) referred to a specimen (*L.A. Craven* 7112) under *P. bowgada* P.H. Weston, commenting that it is morphologically intermediate between *P. bowgada* and *P. hexagona* P.H. Weston, and that the collection locality is well south of the area where one might find either hybrids or an intergradation zone between these taxa. Weston (1995: 113) noted that the specimen had “foliage typical of *P. bowgada* and flowers resembling those of typical *P. hexagona*”. In the absence of corroborating specimens, he did not formally recognise it as a described entity, but regarded it distinct enough to warrant special mention as “*P. bowgada*–*P. hexagona* intermediate” (1994: 127), recommending that further fieldwork and collections were required to resolve its taxonomic status.

Further collections between 1992 and 2003 led to this “intermediate” being recognised as a distinct

taxon and it was given the phrase name *Persoonia* sp. Paynes Find (D. Edinger et al. 313) in 2004 (Western Australian Herbarium 1998–). Additional collections were made during the Department of Environment and Conservation's (DEC) vegetation surveys of Banded Iron Formation (BIF) ranges in the Midwest economic development region, in 2005, and there are now 13 morphologically consistent specimens at the Western Australian Herbarium (PERTH). Weston (1994) suggested that additional collections of this taxon, or similar, may result in *P. bowgada* and *P. hexagona* being regarded as intergrading conspecific taxa, but investigation has shown that these three taxa are consistently different. Consequently, *Persoonia* sp. Paynes Find (D. Edinger et al. 313) is formally described here as the new species *P. manotricha* A.S.Markey & R.Butcher.

Persoonia manotricha is superficially similar to *P. bowgada* and *P. hexagona* in being a tall shrub with long, narrow, subterete, pungent leaves with six, alternating, longitudinal grooves and ridges. Its leaves are most similar to those of *P. bowgada* in being almost terete with narrow grooves (Figure 1A, B), whereas those of *P. hexagona* have more prominent ridges due to the relatively broad grooves, which are characteristically dark-coloured on dried specimens (Figure 1C). The flowers of all three species are morphologically similar in having lateral flaps to the tepals, prominent, recurved anther appendages, a sessile ovary which is not broader than the base of the style, a style which is straight and has eight conspicuous longitudinal ribs, and one ovule. Whereas *P. bowgada* has moderately to densely hairy pedicels and tepals, and a densely hairy ovary with hairs extending along the style to c. two thirds its length, *P. manotricha* has flowers with a lower density of hairs on the pedicels and tepals, and a nearly glabrous ovary and style; like those of *P. hexagona* (Figure 1D–F).

Other regional congeners with subterete, pungent leaves include *P. pentasticha* P.H.Weston and *P. chapmaniana* P.H.Weston, but these taxa are morphologically distinct; comprising Weston's informal *Chapmanniana* Group (see Weston 1995: 110). Like *P. bowgada* and *P. manotricha*, *P. pentasticha* has narrow longitudinal grooves on its leaves (Figure 1G) while those of *P. chapmaniana* have broad, shallow grooves (Figure 1H). Some sterile specimens of *P. manotricha* have been misidentified as *P. pentasticha* in the past but these taxa can be distinguished, even when sterile, as *P. pentasticha*, like *P. chapmaniana*, has five, rather than six, longitudinal grooves in its leaves.

Within the Midwest region, *P. manotricha* is allopatric to *P. bowgada*, which it replaces in the south-east interior, and is sympatric with *P. hexagona*, which overlaps *P. bowgada* to the north-west (Figure 2). *Persoonia manotricha* also has an overlapping distribution with *P. pentasticha*, while *P. chapmaniana* occurs in saline habitats further to the south-west (Western Australian Herbarium 1998–). DEC vegetation surveys of BIF ranges in the Midwest Yalgoo IBRA (Interim Biogeographic Regionalisation for Australia) region, recorded *P. manotricha* (as *Persoonia* sp. Paynes Find (D. Edinger et al. 313)) as occurring near Yandhanoo Hill (Meissner & Caruso, in review) and in the central Tallering Land System of Payne et al. (1998) (Markey & Dillon, in review). *Persoonia hexagona* and *P. pentasticha* were also recorded in these areas during these surveys (*P. hexagona* – Markey & Dillon, in review; *P. pentasticha* – Markey & Dillon, in review; Meissner & Caruso, in review). As part of the specimen identification process, Markey performed leaf-sections so as to accurately distinguish these subterete-leaved species, and the results of this comparative study are presented herein.

Methods

All subterete-leaved *Persoonia* specimens at PERTH were examined, including type material for *P. bowgada*, *P. chapmaniana*, *P. hexagona* and *P. pentasticha*. Observations and measurements of

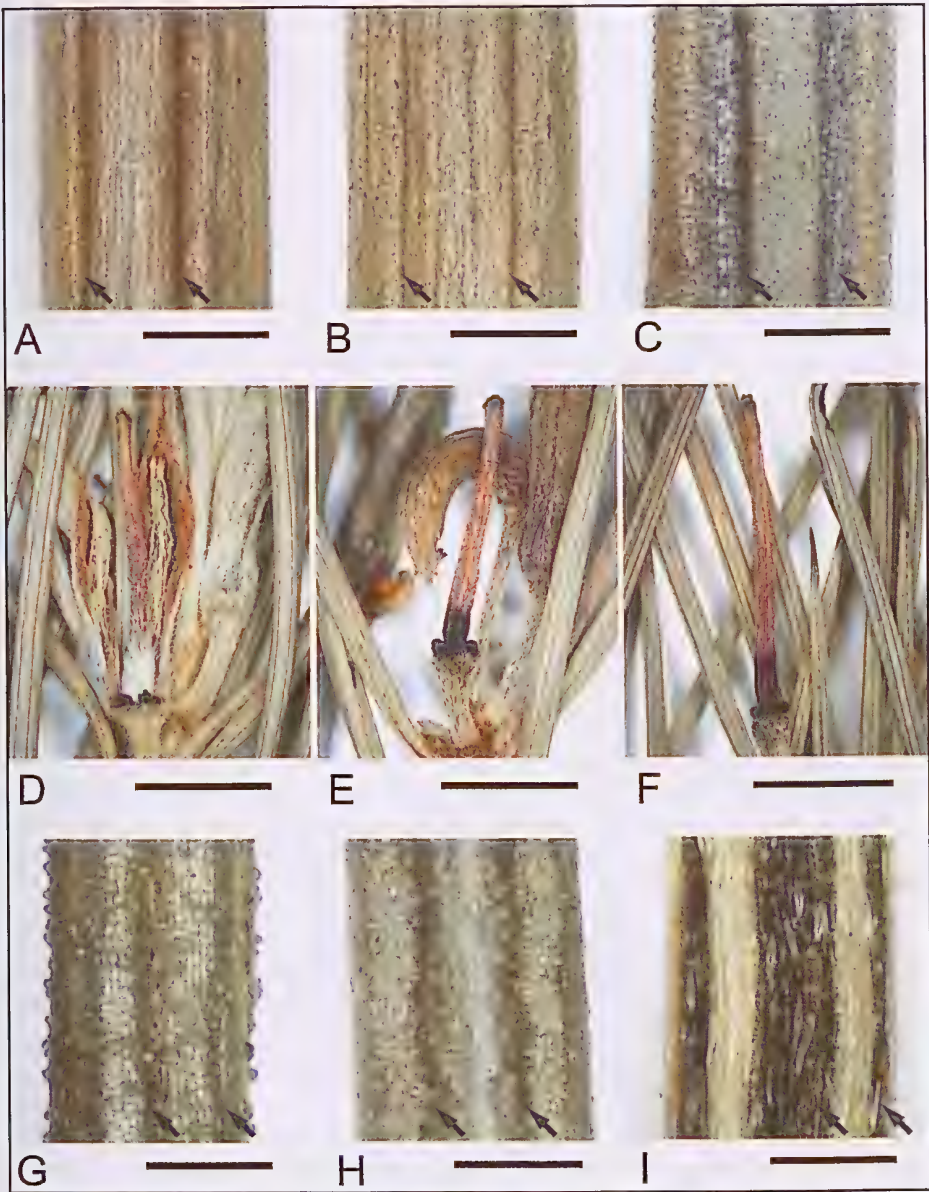


Figure 1. Leaf and gynoecium morphology. A–C – suberete leaves with grooves indicated with arrows; *P. bowgada* (A) and *P. manotricha* (B) have very narrow grooves, *P. hexagona* (C) has grooves as broad as the ridges and darker coloured; D–F – gynoecia with sessile ovaries and straight, longitudinally ridged styles; *P. bowgada* (D) has a densely pubescent ovary and hairs extending > half style length, *P. manotricha* (E) and *P. hexagona* (F) have the ovary and style usually glabrous. The denser pubescence on the tepals of *P. bowgada*, relative to *P. manotricha*, is evident on flowers behind and to the right of the exposed gynoecia; G–I – suberete leaves with grooves indicated with arrows; *P. pentasticha* (G) has narrow grooves and a distinctly scabrous epidermis, mature leaves of *P. chapmaniana* (H) have broader grooves, which are not darkened, and less prominent ridges than *P. hexagona*, but the darker mesophyll is visible in the grooves of young leaves (I). *Persoonia bowgada* (J.S. Beard 7142; holotype); *P. manotricha* (L.A. Craven 7112; holotype); *P. hexagona* (P. Weston 182; isotype); *P. pentasticha* (J.S. Beard 2607; holotype); *P. chapmaniana* (C. Chapman s.n. PERTH 04583493; isotype). All specimens at PERTH. Scale bars = 0.5 mm (A–C, G–I); 5 mm (D–F).

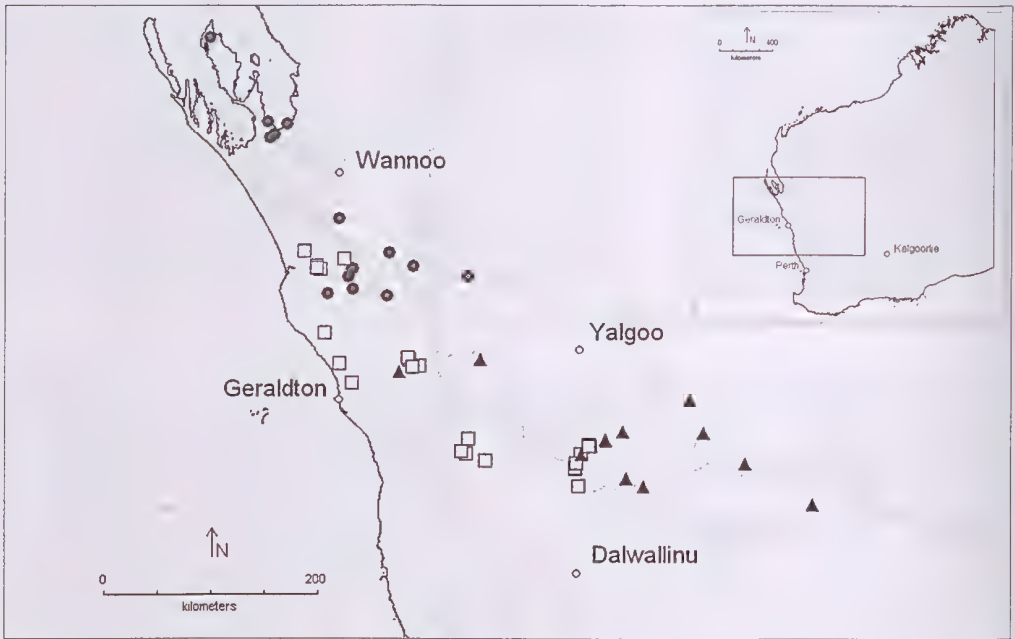


Figure 2. Distributions of *Persoonia bowgada* (●), *P. hexagona* (□) and *P. manotricha* (▲) in the Midwest region of Western Australia.

stems, leaves, pedicels, buds and fruit were made from herbarium specimens, with observations and measurements of tepals, stamens and gynoecia made from rehydrated flowers. Where a character was observed to present differently in the dried and rehydrated state, this has been noted. Descriptive terminology, character state definition and taxonomic formatting follows Weston (1994). As there is only a single fruit on one specimen of *P. manotricha* at PERTH, this structure was not dissected so as to leave comparative material intact. The distribution map was created from herbarium records (PERTH) using DIVA-GIS freeware Version 5.0.2.0 (<http://www.diva-gis.org/>) and shows IBRA Version 6.1 (Department of the Environment and Water Resources 2007) regional boundaries. Herbarium acronyms follow Holmgren & Holmgren (1998–), except EURARDY. and MUL. which represent the Western Australian regional herbaria at Eurardy and Mullewa, respectively.

Leaves were taken from the following PERTH herbarium specimens for anatomical study: *P. manotricha* – D. Edinger *et al.* 313, A. Markey & S. Dillon 3757, A. Markey & S. Dillon 4147; *P. bowgada* – A.H. Burbidge 4548, G. Cassis, M. Wall, C. Symonds & C. Weirauch 11-92, T.F. Houston 1056-1; *P. hexagona* – P.G. Armstrong *s.n.* (PERTH 05967945), J. Docherty 122, G.J. Keighery & N. Gibson 6013; *P. pentasticha* – A. Markey & S. Dillon 3334, S. Patrick 2479, A. Markey & S. Dillon 3333. *Persoonia chapmaniana* was not sectioned, as it did not occur within the Yalgoo survey region, but a comparative tissue diagram appears in Weston (1994: 63; note that the colours demarcating the tissue types are inverted). Five leaves were taken from each specimen, with three specimens selected per species. Leaves were rehydrated in soapy, warm water for between 4 and 24 hours before hand-sectioning. Sections were dropped onto glass microscope slides and mounted in mineral oil before observing under a light microscope. Images were captured using an Orite 1.3M Mega PCCAM (MC 1300) microscope eyepiece camera, and tissue diagrams were traced from prints of these images. Anatomical nomenclature follows Jordan *et al.* (2005).

Leaf anatomy

Persoonia manotricha, *P. bowgada*, *P. hexagona* and *P. pentasticha* all possess more or less terete to subterete, scleromorphic leaves (i.e. small, heavily lignified and with thick leaf cuticles) *sensu* Hill (1998) and Jordan *et al.* (2005). In transverse section, the leaves of all three species are bilaterally symmetric and include a prominent mid-vein located centrally within the leaf, bounded by an adaxial and abaxial fibre cap (Figure 3). A significant proportion of the leaf volume is sclerenchyma, which forms the fibre bundles and caps. Most of the remaining leaf volume is mesophyll, which is darkly stained in dried leaves, possibly owing to the presence of tannins and/or degraded chlorophyll. All species have two vertical bands of mesophyll on either side of the mid-vein from which several spokes radiate outwards to subtend the epidermis lining the grooves (Figure 3). Elsewhere, five or six longitudinally oriented fibre bundles and fibre caps interrupt the mesophyll. As *P. pentasticha* (Figure 3D) and *P. chapmaniana* (Weston 1994: 63) have only five leaf grooves, the two vertical bands of mesophyll unite under the abaxial fibre cap of the mid-vein as they are associated with the abaxial groove (which is absent in the other species). Usually two, and up to four, minor veins lie on either side of the major vascular bundle, at the junction of the mesophyll and fibre bundles in all species (Figure 3). Regular palisade mesophyll was not readily apparent from these crude sections, however, cells were observed to be densely packed within the mesophyll and this is interpreted as palisade.

The alternating longitudinal grooves and ridges on the leaf surface mark the respective absence and presence of the fibre bundles: grooves are formed by the invagination of the epidermis while ridges are formed by fibre bundles evaginating the epidermis. The grooves are more or less the same depth in all species sectioned here, but are distinctly broader in *P. hexagona* (Figure 3C) and *P. chapmaniana* (Weston 1994: 63), while their aperture is closed by the adjacent, over-arching fibre bundles in the other species (Figure 3A, B, D). The grooves terminate in a distinct cavity in *P. pentasticha* (Figure 3D). As noted by Weston (1994, 1995) and observed in this study, stomata are restricted to the epidermis lining the grooves. Stomata are subtended by a deep substomal cavity. Their position within the grooves may minimise water loss, consistent with the xeromorphy of these species (*cf.* Hill 1998; Mast & Givnish 2002). The cuticle is moderately thick in all species, and overlies a uniseriate, tanniferous epidermis. Simple, multicellular trichomes emerge from the epidermis in *P. pentasticha*, their persistent bases imparting a scabrous texture to the epidermis (Figure 1G).

Discussion. The findings of this investigation agree with Weston (1994). *Persoonia manotricha* was observed to have identical leaf anatomy to *P. bowgada* and neither of these species can be confused with the anatomically dissimilar *P. hexagona*, which has six relatively broad grooves, or *P. pentasticha*, which has only five grooves.

Weston (1994, 1995) concluded that the dried guard cells accounted for the dark grooves in *P. hexagona*, but while some herbarium specimens (e.g. *A.C. Burns* 19 (NSW, PERTH), *R. Coveny & B.R. Maslin* RC 7962 (NSW, PERTH), *Wildflower Society of WA* EURA 282 (EURARDY., PERTH)) were observed to have the guard cells darker than surrounding tissue, both the guard cells and their subsidiary cells are at too low a density to account for the deep, total discoloration of the grooves. Similarly, the dark and presumably tanniferous epidermis delineates the circumference of the leaf section in all species, and also cannot account for the dark grooves characteristic of *P. hexagona*. As noted above, a darkly discoloured mesophyll lines the grooves in the dried leaves of all species examined. The colour of the groove appears to be simply a result of its degree of closure: in *P. hexagona* the dark mesophyll is visible through the epidermis and hypodermis owing to the relatively open groove (Figures 1C, 3C), while in the other species the grooves and their dark mesophyll are obscured by over-arching ridges.

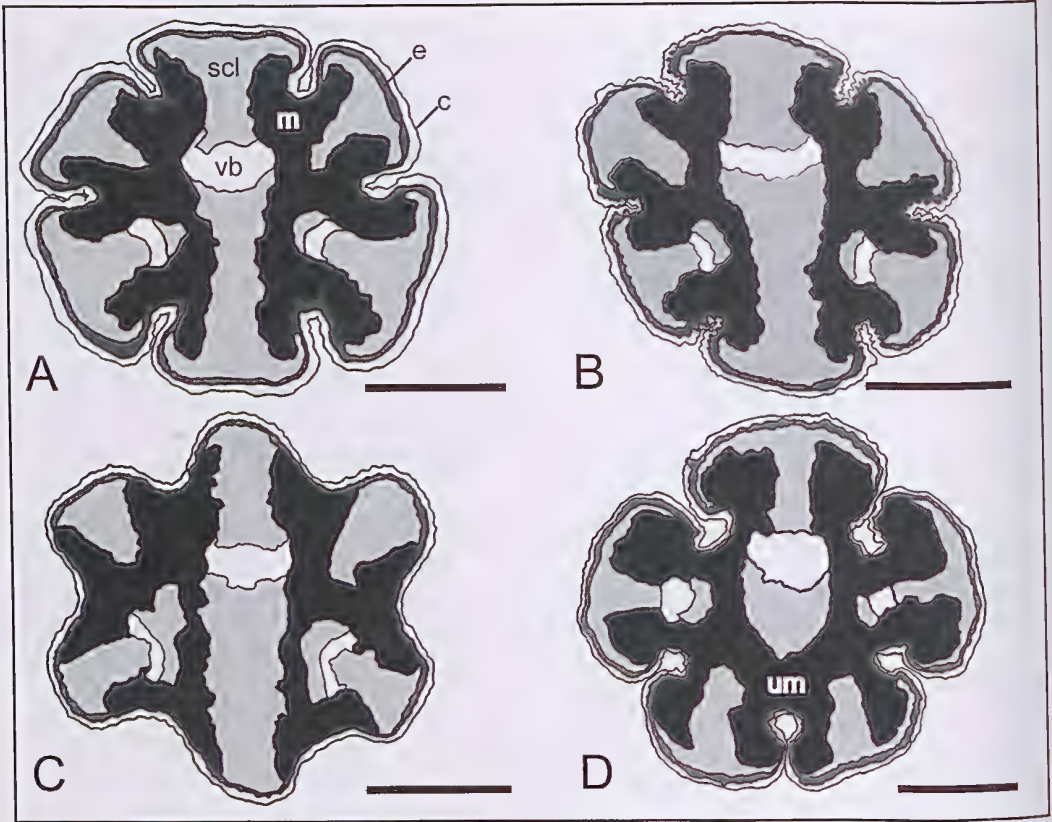


Figure 3. Line drawings of transverse leaf sections traced from photomicrographs. A – *Persoonia bowgada*; B – *P. manotricha*; C – *P. hexagona*; D – *P. pentasticha*. The different tissue types are indicated for *P. bowgada*: vb = vascular bundle (white; note the two smaller lateral veins evident in all four species); scl = sclerenchyma (light grey; forming six (A–C) or five (D) distinct ridges); m = mesophyll (black); e = epidermis (dark band); c = cuticle (light band), with the united mesophyll (um) indicated for *P. pentasticha*. *Persoonia bowgada* (T.F. Houston 1056-1); *P. manotricha* (A. Markey & S. Dillon 4147); *P. hexagona* (P.G. Armstrong s.n., Oct. 1998); *P. pentasticha* (A. Markey & S. Dillon 3333). All specimens at PERTH. Scale bars = 300 μ m.

Examination of herbarium specimens of *P. chapmaniana* found that while the relatively broad grooves are not dark-coloured when the leaves are mature (Figure 1H), and there is no evidence of stomatal guard cell discoloration, young leaves have a distinctly striate appearance, similar to *P. hexagona*, due to the alternating pale-coloured ridges and darker-coloured grooves, through which the underlying mesophyll is visible (Figure 1I).

Of interest is that in each species pair or trio examined here (i.e. five-grooved leaves versus six-grooved leaves), the taxon with the broader grooves in its leaves occurs in a slightly less arid area than its narrow-grooved ally, or allies. This is what would be expected if the closure of the groove by over-arching fibre bundles was a mechanism for reducing water-loss through transpiration.

Taxonomy

Persoonia manotricha A.S.Markey & R.Butcher, *sp. nov.*

Persoonia bowgadae P.H.Weston et *P. hexagonae* P.H.Weston affinis sed sulcis sex longitudinalibus in foliis subteretibus ornatis, perianthio modice piloso, et ovario glabro vel sparse piloso differt.

Typus: 7 km north of Pindar along the Boolardy Station road, Western Australia, 14 October 1981, L.A. Craven 7112 (*holo*: PERTH 01921738; *iso*: CANB, NSW).

Persoonia sp. Paynes Find (D. Edinger et al. 313), Western Australian Herbarium, in FloraBase, <http://florabase.dec.wa.gov.au/> [accessed 28 August 2007].

Erect shrub, 1–4 m high, *c.* 2 m wide, with sub-opposite to sub-whorled branches curved at the base then ascending; means of regeneration and underground parts not known. *Bark* smooth, mottled pinkish-grey, usually fissured and exorticating towards base. *Hairs* of medium length, appressed to antrorsely spreading, shorter and wavy on stems, white-grey to golden-ferruginous. *Branchlets* slightly angular when immature becoming terete, light brown to reddish-brown and moderately to densely hairy when young but glabrescent when mature with patches of wavy hairs persisting around leaf scars. *Leaves* alternate to sub-opposite, linear, symmetric to slightly asymmetric, sometimes twisted to 1/2 complete turn, subterete with 6 narrow longitudinal grooves, 34–94 mm long, 0.75–1.3 mm wide, crowded at end of season's growth, strongly ascending to erect, curved upwards to straight, rigid, not glaucous, concolourous, pinkish at base, moderately hairy when immature, often densely hairy near junction with stem, glabrescent when mature; venation parallelodromous; midvein prominent on both surfaces; marginal veins prominent; intramarginal veins prominent on abaxial surfaces; obscure on adaxial surface; other veins obscure; epidermis papillose or smooth; apex acuminate, senescent, pungent. *Scale leaves* narrowly triangular to ovate, acute and shortly pungent, incurved, 1.7–2.7 mm long, 0.85–1.2 mm wide, densely hairy. *Inflorescences* terminal or axillary, auxotelic or anauxotelic, basitonic, 2–8 flowered; rachis 2.1–15.2 mm long. *Flowers* subtended by scale leaves or leaves, regular, held upright; bud apex sometimes twisted in dried state. *Pedicels* 4.2–17.4 mm long, often slightly longer at base of inflorescence than at apex, moderately to densely hairy, the hairs denser just below the perianth. *Tepals* ± narrow-oblong but attenuate at apex, constricted below anthers, acuminate, 12.5–19.4 mm long, 1.85–2.4 mm wide, greenish-yellow, sparsely to moderately (rarely densely) hairy outside, glabrous inside except for marginal rows of hispid papillae below anthers; lateral flaps 0.5–0.9 mm wide. *Filaments* adnate to tepals, 1.6–3.4 mm long, (1/10–)1/6–1/4 as long as tepals. *Anthers* yellow, introrse, held close together and close to gynoeceum from their bases to tips of loculi, ± straight but abruptly reflexed through 180° at appendage, adnate to tepals for *c.* lower 1/8–1/4 of loculi; connective approximately as wide as loculi; loculi 6.1–9.1 mm long, glabrous; appendage ± oblong to narrowly triangular, constricted just above base, 1–2 mm long, 1/7–1/4 of loculi length. *Gynoeceum* approximately as long as stamens, exserted, 10–14.4 mm long; ovary glabrous or with scattered appressed, greyish hairs, rarely moderately hairy, not contracted at base, not thicker than base of style; style glabrous, with sparse hairs at base or rarely with hairs extending to *c.* 3/4 length, straight, with 8 conspicuous longitudinal ridges, slightly capitate but otherwise ± constant in thickness or tapering slightly from base to tip; abscission zone basal; ovule 1, pendulous. *Hypogynous glands* 4, equal, longer than wide or length and width *c.* equal. *Drupe* oblique ellipsoid, smooth to wrinkled; long axis slightly oblique to attachment point, ± in line with style, 17 mm long, 6.6 mm wide; pyrene not seen; seed not seen. (Figures 1B, 1E, 4)

Selected specimens. WESTERN AUSTRALIA: site 32, 2.5 km WSW of Abbawardoo Pool (Greenough River) on Burton Williams Rd, 1.4 km SW of Burton Rd, 28 Nov. 1997, *P.G. Armstrong s.n.* (PERTH); Blue Hill, Karara Station, 21 Oct. 2003, *E.M. Bennett* BH 5/5 (PERTH); Pindabunna Station site I221, 2 Nov. 1992, *D.A. Blood* 3341 (PERTH); B 10, Burnerbinmah Station, NW of Paynes Find, E boundary South Coonhiago Paddock, 1.6 km S of track from Coonhiago Bore, 19 Oct. 1998, *D. Edinger et al.* 313 (MEL, NSW, PERTH); near Bonnie Venture disused mine site W of Yandhanoo Hill, Ninghan Station, 3 Aug. 2000, *M. Hislop* 2087 (PERTH); Blue Hills Range, survey site WRHL 08, Warriedar Station, c. 7.5 km NW of Warriedar Hill (SH 543) and 1 km E of Southern Cross Well, c. 60 km WNW of Paynes Find, 11 Oct. 2005, *A. Markey & S. Dillon* 3756 (PERTH); Blue Hills Range, Windaning Hill, survey site WIND 12, Karara Station, c. 6.5 km NNE of Mulga Bore, 77 km W of Paynes Find, 17 Sep. 2005, *A. Markey & S. Dillon* 3757 (PERTH); Yandhanoo Hills, survey site YAND 04, c. 1 km NW of Yandhanoo Hills, spot-height 473 m, 4 Oct. 2005, *R. Meissner & Y. Caruso* 341 (PERTH); Whitewells Station NE corner on high lateritic ridge, 8 Oct. 2003, *S. Patrick* 4880 (PERTH); 5–12 km E of Vermin Proof Fence, Bimbijy – Diemals road, 17 Nov. 1993, *H. Pringle* 30136 (PERTH); (I727) Oudabunna Station, 16 Oct. 1993, *S. Van Vreeswyk* 30037 (PERTH).

Distribution. *Personia manotricha* occurs primarily in the Eremaean Botanical Province, in the Yalgoo (YAL) and Murchison (MUR) IBRA regions of Western Australia, with some extension into the Geraldton Sandplain (GSP) and Avon Wheatbelt (AW) regions of the South-West Botanical Province, in the north-west of its range. The species is found between Pindar to c. 60 km west of Paynes Find, an area of the Yilgarn Craton situated c. 100–300 km inland (Figure 2).

Habitat. This species has been found growing on sandy substrates, but has mostly been recorded from gently inclined to moderately steep footslopes, hillslopes and crests of Archaean BIF and associated metasedimentary bedrock, granite and laterite. In a few instances it has also been recorded from sand ridges and a sand plain around a granite dome. It occurs on shallow soils over bedrock higher in the landscape (300–400 m above mean sea level) or on colluvium and rocky ground on the lower slopes. Soils associated with this species are typically acidic, skeletal–shallow red-brown loams/sandy-loams, clayey sand and (occasionally) deeper red sands.

Personia manotricha usually occurs in tall, sparse to open *Acacia* shrublands (e.g. *A. ramulosa*, *A. quadrimarginea*, *A. aulacophylla*, *A. burkittii*, *A. aneura*, *A. sp.* Murchison (B.R. Maslin 7331), *A. sibina*) and co-occurs with *Melaleuca nematophylla*, *Allocasuarina acutivalvis*, *Grevillea obliquistigma*, *Callitris columellaris* and *Exocarpos aphyllus*. More occasionally it occurs under open *Eucalyptus* spp. woodland (e.g. *E. loxophleba*, *E. petraea* or *E. kochii* subsp. *plenissima*). It is often a common component of the vegetation communities in which it occurs, occasionally becoming dominant in the upper stratum (2–4 m shrubs). Understorey vegetation comprises mixed shrubland and herbland including species such as *Prostanthera patens*, *Eremophila glutinosa*, *E. latrobei* subsp. *latrobei*, *Hibbertia arcuata*, *Acacia acanthoclada*, *Philotheca sericea*, *P. brucei*, *Ptilotus obovatus* var. *obovatus*, *Micromyrtus clavata*, *M. trudgenii*, *Mirbelia bursarioides* ms, *Aluta hesperia*, *Cephalopterum drummondii*, *Waitzia acuminata*, *Lawrencella rosea*, *Brachyscome ciliocarpa*, *Erodium cygnorum*, *Goodenia occidentalis* and *Cheilanthes adiantoides*.

In the central Tallering Land System, *P. manotricha* was located within a variety of floristic communities (Community Types 1b, 2, 3, 4b, 5a) while *P. hexagona* was found to be largely restricted to, and an indicator species of, Community Type 2 (Markey & Dillon, in review). On a fine scale, this study found *P. hexagona* to be restricted to the south-west of the survey area, while *P. manotricha* replaced *P. hexagona* in the eastern and northern parts of the survey area.

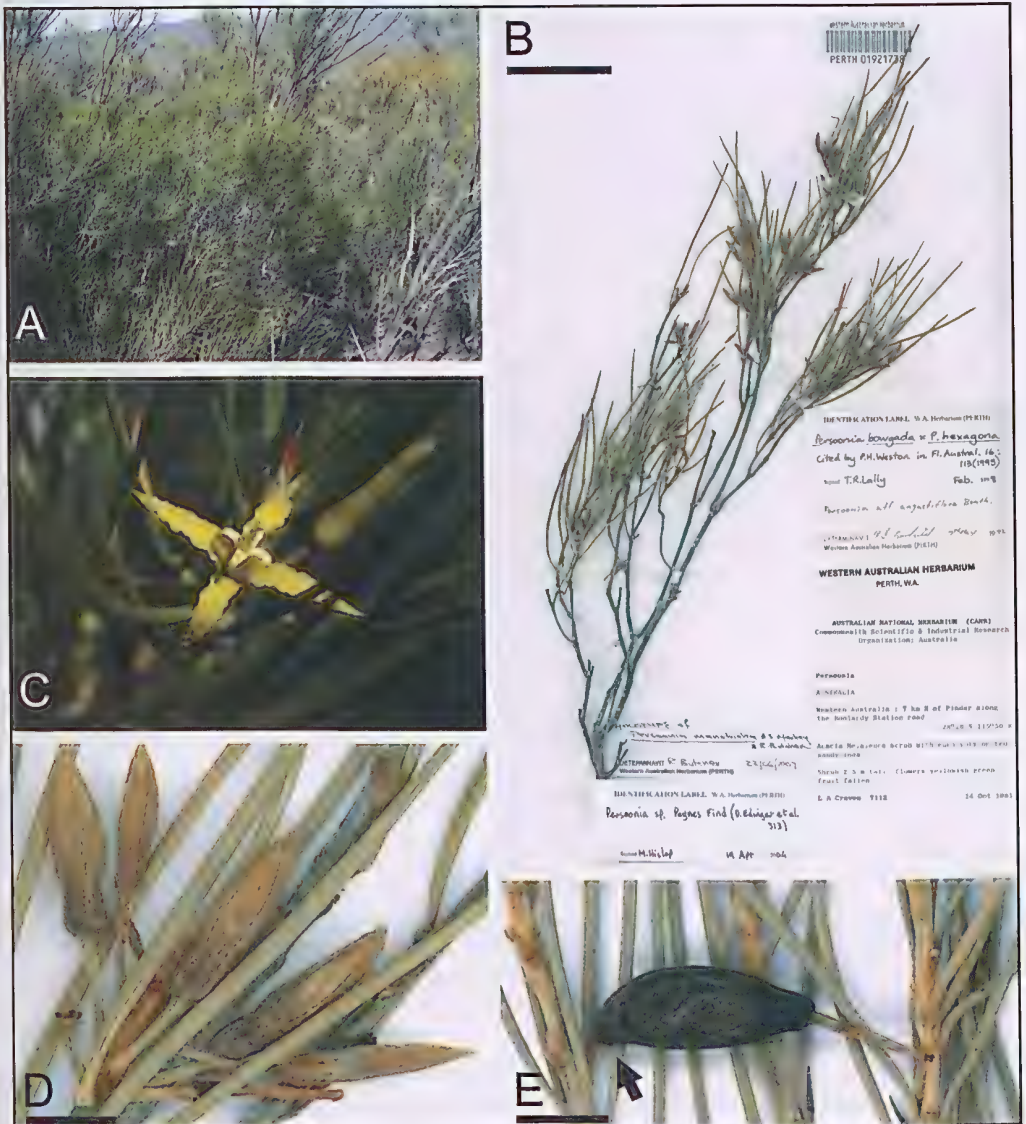


Figure 4. *Persoonia manotricha*. A – habit; B – holotype (L.A. Craven 7112); C – fresh flower; D – pressed flowers (in bud) showing the pedicel length and the lightly pubescent perianth; E – fruit (arrow indicates oblique attachment point, relative to the long axis). Images A, C taken by Steve Dillon at Windaning Hill survey site WIND03; B, D taken from L.A. Craven 7112; E taken from M. Hislop 2087. All specimens at PERTH. Scale bars = 5 cm (B), 5 mm (D, E).

Phenology. Flowering specimens have been collected in November, with buds initiated from early August. A specimen collected in early August 2000 has a mature fruit, but this has probably been retained from the previous year.

Conservation status. This taxon does not have a conservation listing. Although occurring over a relatively large area, the banded ironstone landforms with which *P. manotricha* is commonly associated are currently of specific interest for mining activities (Pringle 1998). The central Tallering Land System is currently unreserved and extensively occupied by mining and exploration tenements (Markey & Dillon, in review). As such there may be a substantial reduction in the available habitat for this species in the future and its conservation status may require review. More immediate threats to the future viability of this species include grazing by feral animals, especially goats (Markey & Dillon, in review).

Etymology. From the Greek *manos* (scanty, thin, rare) and *trichos* (hair), in reference to the very sparse hairs on the ovary.

Affinities. *Persoonia manotricha* consistently differs from both taxa between which it was previously regarded as intermediate, in the combination of a number of morphological characters. These include the length of the pedicel, the moderate pubescence of the perianth and the glabrous to sparsely pubescent ovary.

Persoonia bowgada is hypothesised here to be the sister taxon of *P. manotricha*: both are tall shrubs with terete, more or less smooth, pungent, six-ribbed leaves in which the longitudinal grooves are almost closed over, and, as previously outlined, their morphologically similar flowers are distinguished primarily on pubescence characters. Both taxa have the pedicels at the base of inflorescences slightly longer than at the apex, corresponding to the age of the flowers, and although this results in a slight overlap in values, the pedicels of *P. manotricha* are usually considerably longer than those of *P. bowgada* (4.2–17.4 mm long, compared with 2.4–7 mm long). In *P. bowgada* the central axis of the fruit is in line with both the style and the point of attachment, whereas in the one fruit of *P. manotricha* observed, the central axis is slightly oblique with reference to the style and more so relative to the point of attachment (Figure 4E). This fruit was similar to those of *P. hexagona* in this respect. More subtly, *P. bowgada* appears to have hypogynous glands that are broader relative to length and more keeled on the abaxial surface.

Persoonia hexagona is similar to *P. manotricha* in habit and in the pubescence of its flowers, but differs significantly in having leaves that are generally glossy in appearance and are relatively broadly grooved; with the grooves in dried specimens frequently noticeably dark, due to the visible underlying mesophyll blackening with desiccation.

The superficially similar species *P. pentasticha* can be easily distinguished by its habit, being a low shrub 0.4–1 m in height, and by having only five grooves in its distinctly scabrous leaves (Figures 1G, 3D). The axillary, exclusively anauxotelic inflorescences of *P. pentasticha* also have more densely pubescent peduncles, rachises and pedicels, a higher number (1–15) of smaller flowers (7–12 mm long), which are strongly constricted near the base and which lack lateral flaps on the tepals. Additionally, the anthers of *P. pentasticha* have smaller (to 0.6 mm long) appendages and the gynoeceum comprises a glabrous, globose, stipitate ovary containing two ovules, and a style which is ribbed only in the lower half and is distinctly curved near the apex.

Notes. One specimen of *P. manotricha* (P.G. Armstrong s.n. PERTH 05963494) has the perianth shortly

and densely pubescent with a greater density of hairs on the ovary and style. As such it is similar to *P. bowgada*, but there is variation in the density of the gynoecium pubescence between flowers on the same specimen, with some almost glabrous. Pedicel lengths also place the collection in *P. manotricha*.

Taxonomic key

The key presented here is a revised portion of Weston's key to the Western Australian species of *Persoonia* possessing actinomorphic flowers and anther appendages (1995: 51–53). This key commences at Weston's lead 12: (1995: 52) and is to be inserted at that point. As one specimen of *P. manotricha* has a more pubescent perianth and slightly more pubescent ovary than all the others, leads to identify this taxon have been inserted into the key in two places to reduce potential misinterpretation and misidentification. New leads have been marked with an asterisk (*). Numbering has been changed throughout, where appropriate.

- 12: Leaves less than 2 mm wide
24. Ovary moderately to densely hairy
25. Tepals glabrous **P. chapmaniana**
- 25: Tepals moderately to densely hairy
26. Leaves concave, with no other grooves or prominent parallel veins **P. rudis**
- 26: Leaves subterete to compressed but not concave, with 6 prominent parallel veins
27. Leaves pungent
- *28. Tepals moderately to densely hairy, ovary densely hairy, pedicels 2.5–7 mm long **P. bowgada**
- *28: Tepals sparsely to moderately hairy, ovary moderately hairy, pedicels 4.2–17.4 mm long **P. manotricha**
- 27: Leaves not pungent
29. Inflorescences 1–4-flowered; flowers mostly subtended by scale leaves; leaves smooth to slightly scaberulous **P. angustiflora**
- 29: Inflorescences 1–20-flowered; flowers subtended by scale leaves and leaves; leaves scabrous **P. papillosa**
- 24: Ovary glabrous or, rarely, sparsely hairy
30. Anther appendage less than 1 mm long, either not recurved or recurved less than 90° **Follow Weston (1995: 53, includes P. pentasticha)**
- 30: Anther appendage more than 1 mm long, recurved through 90–180°
37. Longest leaves more than 5 cm long; tepals sparsely to moderately hairy
- *38. Leaves with 6 prominent parallel ridges, grooves broad and blackening inside **P. hexagona**
- *38: Leaves with 6 contiguous parallel ridges, grooves very narrow and not blackening inside **P. manotricha**
- 37: Leaves less than 5 cm long; tepals glabrous
39. Anther appendage filiform **P. filiformis**
- 39: Anther appendage obtuse or acute
40. Leaves pungent **P. sulcata**
- 40: Leaves sharp but never pungent **P. striata**

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